



# Ventilation in buildings

**Please note that this bulletin has been updated to include the provisions for condensation management which came in to effect with the adoption of BCA 2019.**

**The purpose of this technical note is to alert building designers and practitioners to the requirement of adequately controlling the accumulation of harmful contamination of micro-organisms, pathogens and toxins when installing a mechanical air-handling system to provide ventilation in a residential building.**

The Building Commission has investigated several occurrences of condensation and mould within residential apartments due to insufficient ventilation in spaces where there is no natural ventilation available and mechanical ventilation is provided. Investigations conducted by the Building Commission found that installed ventilation systems and the nature and size of openings in external walls failed to maintain adequate air quality.

## When is mechanical ventilation required?

Provisions for ventilation in residential apartments are contained in the Building Code of Australia (BCA) Volume 1. Performance Requirement FP4.3 of the BCA states that a space in a building used by occupants must be provided with means of ventilation with outdoor air which will maintain adequate air quality. The BCA Volume 2 contains a similar Performance Requirement for houses.

BCA clause F4.5 specifies deemed-to-satisfy provisions to comply with the ventilation Performance Requirement of rooms in residential apartments (sole occupancy units), which requires ventilation to be provided to a habitable room, sanitary compartment, bathroom, shower room, laundry and any other room occupied by a person for any purpose by either:

- natural ventilation complying with F4.6 (permanent openings, windows, doors or other devices which can be opened); or
- mechanical ventilation or an air conditioning system complying with AS 1668.2 and AS/NZS 3666.1.

The objective of the BCA is to safeguard occupants from illness or loss of amenity due to lack of air freshness. Therefore, when a space (ie room) within a building does not have access to direct natural ventilation, the space must be provided with mechanical ventilation and make-up air in accordance with AS 1668.2.

## Ventilation of enclosures

When a mechanical ventilation system is installed within a building, AS1668.2 requires that air exhausted from enclosures shall be continuously replenished by outdoor air, transfer air or by make-up air of an acceptable quality from outside or the adjacent enclosure. Often make-up air is insufficient when the room providing the ventilation is likely to produce large amounts of condensation, eg laundry, bathroom, kitchen. Make-up air cannot be drawn from an adjoining enclosure if that enclosure requires mechanical ventilation, ie sanitary compartment.

From our investigations, it appears that in apartment-style buildings laundry enclosures are being designed and constructed within the sanitary compartments and therefore the exhaust fan servicing the laundry obtains make up air from the sanitary compartment.

Although AS 1668.2 allows the use of common exhaust systems for certain enclosures, including a laundry enclosure and a sanitary compartment, problems can still arise from this type of design as it relies on action by the occupant to enable make-up air.

In cases where a sanitary compartment has no natural ventilation, replacement air or make-up air is obtained from the adjoining room. The adjoining room should comply with the provision for natural ventilation (BCA Part F4.6).

When exhausting air from a well-sealed building, designers, building surveyors and builders must also think about where the replenishment or make-up air will come from. The buildings in older style construction were less airtight which allowed an easy make-up airflow path for exhaust systems. New buildings have well-sealed facades to enable savings from energy efficiency performance of the building and occupants often keep windows closed for reasons of security and weather, particularly in apartment buildings. However, this can lead to the following problems:

- a. Make-up air drawn through gaps and service penetrations does not meet acceptable qualities or is to a level significantly below that of the outdoor air in the locality.
- b. Restricted make-up air paths reduce exhaust airflow rates. The fan just does not work – there is no way for fresh air to come back into the house or apartment.
- c. Inadequate supply or exhaust ventilation reduces the amenity of the indoor environment.

Explanatory notes at clause C3.8.1 in AS1668.2 highlight that there are issues with the effectiveness of ventilation systems in sole occupancy units within apartment buildings due to the factors listed above and that permanent natural ventilation, ducted outdoor air ventilation or even a tempered mechanical supply ventilation system may be required to fulfil the objective of the Standard and/or local regulations.

### **Issues to consider with regard to air movement/ventilation**

- Design of the space in relation to occupant use.
- Occupant use.
- Production of water vapour (consider ways of reducing condensation. Eg condensing clothes dryers).
- Cold surfaces, ie material fabric of the building.
- Methods of replenishment air.

### **Contamination through condensation**

A number of occupants of apartment buildings who have made complaints to the Building Commission have remarked that it was common for condensation to run down the external walls and windows inside the building.

In these cases, heated water vapour appeared to escape from the laundry/bathroom as the draw capacity of the mechanical ventilation appeared to be insufficient/restricted for the use that was required. Water vapour escaped into adjoining rooms travelling on warmer air until reaching wall surfaces with a lower temperature. The heated water vapour condensates and either soaks into the wall or runs down the wall surface.

In some locations, such as inside cupboards and in stored clothing and shoes, mould had begun to grow. When heated water vapour meets cooler objects, dew point is reached; condensation begins and over time mould begins to grow. The mould will continue until these conditions are changed.

## Who is responsible for controlling condensation?

Ultimately there is a shared responsibility by the designer, the building surveyor, the builder and the occupants of the building to control ventilation within the building. Builders, however, will be the ones that complaints will most likely be made against by occupants and where the primary objective of the BCA is not met, builders may be required to address the cause of the contamination occurring.

## BCA condensation requirements

The 2019 edition of the BCA introduced new requirements for condensation management. This included new Deemed-to-Satisfy provisions for pliable building membranes where installed in a wall and flow rate and discharge requirements for exhaust systems installed in a kitchen, bathroom, sanitary compartment or laundry. Condensation Management requirements can be found in both Volume One and Two of the BCA. The BCA forms part of the National Construction Code and is available for free from the Australian Building Codes Board website [National Construction Code | NCC \(abcb.gov.au\)](http://www.ncc.gov.au).

The BCA condensation management provisions and AS 1668.2 requirements for mechanical ventilation in buildings may not necessarily prevent condensation from occurring. Therefore, additional measures for mitigating condensation issues may be prudent for buildings. For additional guidance on the risk of condensation and its consequences to consider in the design and construction of buildings refer to the ABCB Handbook [Condensation in Buildings 2019 | ABCB](http://www.abcb.gov.au/publications/condensation-in-buildings-2019).

### Disclaimer

The information contained in this technical note may not represent all regulations, standards and codes that apply to this topic. As regulations, standards and codes are referred to in part, practitioners need to consider these requirements in full to ensure you meet the applicable building standards.

30 May 2014